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ABSTRACT

This study examined the structural organizational characteristics of 51 higher education institutions in a single state (23 four-year and 28 two-year campuses) in relation to student performance and growth. In all, 7,658 students completed the assessment instrument at the end of their second year. The study found that organizational measures of mission, size, wealth, complexity, and selectivity are statistically represented by the two-year versus four-year college dimension. Findings indicate that the different missions of two-year versus four-year campuses do indeed exert significantly different influences on undergraduate grade point average and self-reported growth. The study also used ordinary least squares (OLS) regression and hierarchical linear modeling (HLM) to examine these influences. While the significant student level predictor variables in the OLS and HLM models are substantially similar, the HLM results are more robust because they take into account the interaction effects between campus mission and students. (Contains 2 figures, 10 tables, and 80 references.) (Author/SLD)

# Comparing Student Performance and Growth in Two and Four Year Institutions



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# Comparing Student Performance and Growth in Two and Four Year Institutions

## Abstract

This study examines the structural/organizational characteristics of 51 higher education institutions in relationship to student performance and growth. The study first finds that organizational measures of mission, size, wealth, complexity, and selectivity are statistically represented by the two-year versus four-year college dimension. Findings indicate that the different missions of two-year versus four-year campuses indeed do exert significantly different influences on undergraduate GPA and self-reported growth. Next the study uses both OLS regression and HLM to examine these influences. While the significant student level predictor variables in the OLS and HLM models are substantially similar, the HLM results are more robust because they take into account the interaction effects between campus mission and students.

# Comparing Student Performance and Growth in Two and Four Year Institutions

## Introduction and Need for the Study

In discussing his "input-environment-output" (IEO) model, Astin notes the lack of empirical studies analyzing multi-campus data and the important contribution of structural/organizational influences on student outcomes (1977, 1984). Several causal models have been developed hypothesizing that campus structural characteristics and college organizational climates produce environments that impact student outcomes (Pascarella, 1985, Weidman 1989). Pascarella and Terenzini (1991) note the inconsistency in the evidence about organizational influences and discuss the difficulties of using institution level variables to predict individual level outcomes. These concerns combined with newly developed software have stimulated higher education researchers to undertake multi-level modeling in their college effects research (Ethington 1997, Patrick 2001, Porter & Umbach 2001). In theory, hierarchical models allow researchers to arrive at more accurate results by taking into account the nested structures of the institution's sub-environments. In reality, multi-level modeling adds complexity and density to the analysis, possibly overstates the strength of the evidence, and may not be necessary (Ethington 1997). Some researchers question the uncritical use of complicated modeling and believe that traditional OLS approaches perform equally well under most conditions (Busing 1993, Draper 1995, deLeeuw & Kreft 1995, Morris 1995).

This is an important and timely issue in higher education because of government, trustee, and accreditation interest in institutional performance. Concern about the student outcomes of college has become quite intense in the past decade. The guidelines and mission statements of both regional and program-specific accrediting agencies reveal that student outcomes evidence is an important component of today's accreditation standards. Regional Accrediting agencies like the North Central, Middle States, Southern, and Western Associations for Schools and Colleges now demand evidence of student learning and other outcomes in their reviews. This has resulted

in greater campus attention to policies and practices that improve these student outcomes (Carnevale 2000. Lubinescu. Ratcliff & Gaffney 2001, McMurtrie 2000, Semrow et al. 1992). Research has documented the effect that accreditation, state characteristics, and institutional dynamics have on the kind of student assessment evidence that is collected (Peterson & Augustine, 2000).

Trustees and government officials alike have become results-oriented and reach for performance indicators as signs of institutional effectiveness, and as justifications for higher education funding (Burke & Serban. 1998; Burke, 2000; Ewell, 1998). Student outcomes evidence can be used for both internal and external purposes. Institutions can use performance evidence to make internal budget adjustments, or to benchmark against other institutions for improvement initiatives (Massy 1994). Performance indicators also help institutions demonstrate their performance to stakeholders such as legislators, employers, parents, media, and accreditation agencies (Cabrera, Colbeck, and Terenzini, 2000; Ewell, 1998). In order to attract sufficient state funding, public two-year and four-year institutions increasingly must meet criteria set by their state governments. Thus, it is especially important to know if particular structural/organizational characteristics are significantly associated with positive student performance, learning, and growth.

States vary not only in the types and number of performance indicators, but also in the ways they apply them to two-year versus four-year institutions. Both Burke (2000) and Ewell (1998) call for the distinction between indicators at two-year institutions and four-year institutions, but many states attempt to create indicators that are applicable to all institutional types. Specific indicators developed from four-year institutional models may not be appropriate for the two-year sector. Without adequate research evidence, the dominant four-year models may be inappropriately applied to the two-year sector (Strauss, 2000).

This study is a modest attempt to close the gap in the research comparing two-year and four-year institutions. Cohen and Brawer (1996) cite the small amount of attention given to community college research, including the "... scant handful of studies that include community college student data [that] are among the more than twenty five hundred reports cited by Pascarella & Terenzini in their volume, How College Affects Students (1991)". Outcomes from research on four-year institutions cannot automatically be generalized to Community Colleges

(Cohen and Brawer 1996, Layzell 1997), and compared to studies of four-year institutions, there is a relative dearth of research on the two-year sector.

Thus, using a population of several thousand students at 23 four year and 28 two year institutions, this study has two goals:

1. To examine the structural/organizational characteristics that influence student performance and growth.
2. To compare the results of this examination using both traditional OLS regression and HLM.

## Conceptual Frameworks

Higher education scholarship has produced an array of theories and models that explain the relationship between students and their colleges. Drawing from this pool of available models, at least four major assertions regarding the interactions between students and their colleges, and the influences on student outcomes can be cited (Pascarella & Terenzini, 1991, Volkwein, Szelest, Cabrera, & Napierski-Prancl, 1998; Volkwein, Valle, Blose, & Zhou, 2000). The most traditional view is that pre-college characteristics such as student backgrounds, academic preparedness for college, and clear goals are the main factors accounting for differences in academic performance, persistence behavior, and other educational outcomes (Astin, 1991; Feldman & Newcomb, 1969; Stark et al., 1989).

A second group of alternative yet complementary perspectives fall under the general description of student-institution fit models (Pascarella & Terenzini, 1991). Perhaps the most widely researched of these models claims that student persistence and growth depends on the degree of successful integration into the academic and social structures of the institution (Spady 1970, 1971; Tinto 1987, 1993). Another student-institution fit model focuses on the importance of student involvement and effort (Astin 1984, Pace 1984). Also within the student-institution fit argument is the importance of support from friends and family in college adjustment (Bean 1980; Bean and Metzner 1985; Nora 1987; Nora et al. 1990). Yet another branch of this literature emphasizes the importance of financial variables and the student's ability to pay (Cabrera, Nora, & Castaneda, 1993; St. John, 1992). While the majority of these models have been constructed to explain one outcome, student persistence, several researchers have successfully used these and

similar models to explain other outcomes including student growth and satisfaction (Kuh, et al., 1997; Terenzini et al., 1980, 1982, 1984, 1987, 1995, 1996; Volkwein, King, & Terenzini, 1986, Volkwein & Lorang, 1996; Volkwein, Valle, Parmley, Blose, and Zhou, 2000). More recently, one model has been presented to explain the learning and cognitive outcomes of community college students (Voorhees 1997). More than the others, the Voorhees model emphasizes the competing demands of family, work, and community.

A third set of assertions emphasizes the importance of campus climate in student adjustment (Bauer 1998). Perceptions of prejudice and discrimination have gained increased attention as factors accounting for the differences in persistence rates between minorities and non-minorities (e.g. Cabrera et al. 2000; Fleming, 1984; Hurtado, 1992, 1994; Hurtado, Carter & Spuler, 1996; Loo & Rolison, 1986; Murguía, Padilla, & Pavel, 1991; Nora & Cabrera, 1996; Smedley, Myers & Harrel, 1993). Reynolds (1999) recognizes that "...all students need a safe and affirming environment, where diversity is valued, in order to learn and grow. " (p. 213-214). Students need to be able to function without fear of oppression, stigma, and violence in order to maximize their chances of success. Creating a campus climate for all students that allows for optimal development is a major factor in successful student outcomes.

Fourth, structural/functional perspectives drawing from the literature on organizations, encourage researchers to give greater attention to those variables that reflect the influence of organizational characteristics (Hall 1991). Studies of colleges and universities, as particular types of organizations, have shown that campus mission, size, wealth, complexity, and selectivity exert significant influences (ranging from small to large) on a variety of internal transactions and outcomes including student values, aspirations, educational and career attainment (Pascarella & Terenzini, 1991; Volkwein, King, & Terenzini,1986; Volkwein, Szelest, Cabrera, & Napierski-Prancl, 1998). However, the Pascarella Model (1985) and the Weidman model (1989) are the only models that give prominence to campus organizational and structural characteristics as influences on student outcomes.

These four types of theoretical perspectives and their models provide the conceptual foundation for the research reported here. In constructing the data and measures for the current study however, two models are used more heavily than the others -- the Cabrera, Nora, and

Castaneda (1993) Integrated Model of Student Persistence, and the Pascarella (1985) General Causal Model.

The Cabrera et. al. model merges the best elements of Tinto's (1987) Student Integration Model and Bean's (1980) Student Attrition Model (Cabrera, Castaneda, Nora, & Hengstler, 1992). Cabrera et. al. recognized the similarity between the two models, and tested their overlap. The two models were found to be significantly related, and were quantitatively amalgamated through structural equation modeling, thereby producing this Integrated Model of Student Persistence. Many of the concepts in this model and the survey items used to reflect those concepts were incorporated into the Albany Outcomes Model and subsequently into the State University of New York Student Outcomes Survey (Volkwein 1992, Volkwein et al. 2000).

The Pascarella (1985) General Causal Model specifies five elements influencing student learning and cognitive development. These elements are student background/pre-college traits (such as aptitude, personality, ethnicity, high school preparation), structural/organizational characteristics of institutions, (such as size, mission, wealth, complexity, and selectivity), interactions with agents of socialization (faculty and peers), institutional environment (such as classroom experiences, student services, tolerance, safety), and quality of student effort. The Pascarella model assumes that all these components contribute directly or indirectly to learning and cognitive development. Pascarella intended this model to be used as a basis for future research, to be refined later. Reviews of the literature reveal few empirical studies using the Pascarella model as a conceptual framework (Volkwein et al. 2000).

Also of interest to this study is Pascarella's call for multilevel analysis of student outcomes. He finds fault with exclusive use of either the institution or the individual as the single level of analysis. "One helpful direction for future research in this area would be to analyze data at both levels of aggregation (institution and individuals) whenever possible" (p. 51).

## Methodology

Using the concepts and models discussed above, this research examines student performance and self-reported growth at 51 public institutions of higher education in a single state (23 four-year and 28 two-year campuses). There are 7,658 students in the database who

completed the assessment instrument at the end of their second year (2,576 at four-year campuses and 5,082 at two-year campuses). The study is limited to second year students ensuring that they have spent approximately the same amount of time at their respective institutions. The database contains both institutional and student level data.

## Data Collection

This research undertakes a secondary analysis of data collected by a consortium of 51 participating institutions and the State University of New York System. The institutional data were gathered from multiple sources, all for the 1996-97 academic year. A committee of cooperating researchers and administrators from participating institutions developed the survey instrument, based in part upon the Albany Outcomes Model and the student surveys developed by the State University of New York at Albany (Volkwein, 1992). The variables and scales used in the analysis draw directly upon the constructs from the literature in general, and from the Cabrera and Pascarella outcomes models in particular. The survey was administered across the SUNY System in Spring 1997 under conditions that varied slightly from campus-to-campus, but which resulted in a representative group of respondents. The survey for the database was printed and scored by the American College Testing program. Student level variables are drawn from the survey instrument. Institutional level data are generated from the 1996-1997 Integrated Post-secondary Education Database System (IPEDS). The database is stored and analyzed using SPSS pc version statistical software and HLM (version 5.02) statistical software.

## Analytical Techniques

Based upon the Cabrera Integrated Model of Student Retention and the Pascarella General Student Outcomes Model, there are a number of variables and constructs hypothesized to influence the two outcomes selected for this study – student GPA and self-reported growth. Previous studies using this dataset have conducted factor analysis to see if the items clustered consistently with the outcomes theory and the models (Volkwein & Cabrera 2000, Volkwein et al. 2000). Since those efforts were successful, we were able to forego principle components analysis in this study, and instead moved directly to scale construction. The alpha reliabilities for the multi-item scales are recalculated for this population; all exceed .70 and the majority exceed .80. The descriptive statistics for all the included variables are shown in Table 1. Specifically, the variables included in the study include the following:

Dependent Variables-GPA and Growth

For the purposes of this study, student performance, learning, and growth is taken from two perspectives: students and faculty. First, student perceptions of growth are obtained from students' self-assessment of their own intellectual growth (acquiring information, ideas, concepts, and analytical thinking) on a five-point growth scale (1= none and 5= extremely high). Second, faculty perceptions of student learning are measured by the cumulative grade point average reported for each student.

Independent Variables

Student Pre-college Characteristics

Student characteristics include age, male/female, racial/ethnic group membership, employment, marital status, dependent children, socioeconomic background, SAT score, high school rank, and high school average.

Structural/Organizational Characteristics of Institutions

Key indicators for structural/organizational characteristics used in previous literature have included size, wealth, complexity, mission, and selectivity (Volkwein, Valle, Parmley, Blose, & Zhou (2000). Mission is a dummy variable where 1=four-year, 0=two-year. Size is represented by the total undergraduate headcount enrollment at the institution. Wealth includes measures of revenues and expenditures per annual FTE enrollment. The complexity measure reflects the number of organizational units headed by a Vice President or Dean (or equivalent). Selectivity includes the percentage of applicants admitted.

Financial Need/Aid

The amount of financial aid generally is an objective measure of student need and socioeconomic status. Recent research (Nora, 1990; Voorhees, 1985) demonstrates that objective indicators of finances (unmet need and student aid programs) influence college academic performance. Financial attitudes (used here) generally reflect the subjective component of student financial aid. Financial aid reflects the amount of funding other than personal funds, obtained for the student's college education, or in other words, student neediness. Indicators of financial aid include the extent to which a student reports her or his education being supported by grant sources. These items asked the respondent to indicate the influence, zero, minor, or major, that Federal grant funds and state grant funds have on financing the student's education (alpha .84). Equal opportunity funding and college-work study data, asked in the same format were included as single items in the model. Financial attitudes reflect the student's perception of the difficulty of financing her or his education. This construct is a more attitudinal and perceptual

judgment by the student than the previously defined financial aid measure. A single survey question specifically asked the student's perception of difficulty in financing her or his education assess financial attitudes for this study.

Encouragement from significant others

Encouragement from significant others includes perceived support from family, and peers to pursue and continue in college. Measurements of encouragement include student perceptions of family support. and the perceived support of peers to continue in college.

Interactions with Agents of Socialization

This study also includes student reported variables reflecting the extent of interactions including the amount of faculty interactions (amount of direct contact with faculty, satisfaction with faculty and advisors) and the extent to which the students interacted with their peers (extent and value placed upon peer interactions).

Institutional Environment/Climate

The academic and social environment of each campus is reflected in the measures of classroom experiences (stimulation in class. faculty preparation, classroom satisfaction), perceptions of openness and tolerance (satisfaction with the atmosphere of understanding, freedom from harassment. racial harmony, understanding of lesbian/gay/bisexual issues, and security/safety), perceptions of low prejudice (by peer students, faculty, and administrators), satisfaction with various student services, and satisfaction with various academic support services and facilities.

Quality of Student Effort

Student effort is measured by student perception of good study habits and giving a high priority to studying.

Institutional Commitment

Institutional commitment in this study is a scale of four items reflecting the student's overall impression of, sense of belonging to, satisfaction with, and willingness to attend the institution again. (alpha = .86)

Thus. we assembled a rich and large dataset that allows us to examine the many potential influences on the two outcomes. We set out to use both HLM and the more traditional OLS multivariate analysis to see if the results differ. The study includes both institutional level and individual student level data which is nested within 51 the campuses. The structural/organizational characteristics from each campus comprise the institutional level data.

Hierarchical linear modeling (HLM) is normally recommended to respond to the multilevel nature of the measures. However, there is some skepticism about the need to engage in such complicated analysis when the more traditional OLS regression analysis may produce the same results.

HLM varies from traditional OLS regression in that the regression coefficients can be treated as random effects by including an error term for the level 1 (i.e. student effects) in the level 2 (i.e. institution) model, resulting in a decomposition of the variance of the dependent variable (institutional commitment) into within institution and between institution effects (Bryk & Raudenbush, 1992; DiPrete & Forristal, 1994).

HLM uses regression equations from both level 1 and level 2 data to derive a fitted value for the dependent variable. In the case of the present study, the level 1 variables are the student pre-college characteristics, encouragement from significant others, financial aid, financial attitudes, social integration, social growth, academic integration, academic growth, and college grade point average. The level 2 variables are the institutional structural/organizational characteristics of mission, size, wealth, complexity, and selectivity. The level 1, or student variables are "nested" within the level 2 units, the individual institutions.

Using HLM, the researcher first designates the dependent variable. Next, the student variables are selected. For each student variable, and the regression intercept, institutional variable(s) can be selected to determine if the institutional characteristic has an effect on the relationship between the student variable and the dependent GPA or self-reported growth.

Simply stated, HLM determines the regression equation by calculating the beta weight for each student variable from the sum of the level two variables and random error. The resulting coefficients for each student variable are used to calculate the final regression equation by substituting the level two equations back into the level one equation (Bryk and Raudenbush, 1992; Singer, 1998; Von Seckor & Lissitz, 1997).

# Results

## Grade Point Average Analysis

OLS Regression

An OLS regression was used to predict grade point average. The independent variables were entered in blocks according to the Pascarella model. Listwise deletion of missing cases was used for missing data. The variables were entered with pre-college variables in the first block, structural organizational characteristics second, interactions with agents of socialization and institutional environment third, and the final block consisting of institutional commitment and student effort.

The results, reported in Table 2, indicate that high school rank, total SAT score, number of hours worked per week, being male, the mission of the institution, classroom experiences, and effort are all significant predictors of grade point average. The adjusted $R^2$ for this model was .272, indicating that this model accounted for 27% of the total variance in grade point average scores.

INSERT TABLE 2 HERE

**HLM Analysis**

Unconditional Model

HLM assumes that some of the variation in student grade point average is contained in the between institution (level 2) model. Indictors of this variance are shown in Table 3. An unconditional model (a model with no level one or level 2 predictors, analogous to a one-way ANOVA) was conducted to test this assumption (Bryk and Raudenbush, 1992; Singer, 1998).

Table 3 indicates that the maximum likelihood point estimate for the grand-mean grade point average is 2.92 with a standard error of .02, indicating a 95% confidence interval of 2.92+or- 1.96(.02)= (2.88,2.95). The estimated value of the variance at the student level, or within schools, of grade point average, represented by sigma squared, is .42. The estimated value of the variance at the school level (i.e. between individual institutions) of grade point average, represented by tau. is .02. These estimates indicate that most of the variation in the outcome is at

the student level, although a substantial and statistically significant portion ($p<.01$) exists between individual schools.

INSERT TABLE 3 HERE

Intraclass Correlation

A second way of examining the variance between institutions is to estimate an intraclass correlation (Bryk and Raudenbush, 1992; Kennedy, Teddlie, & Stringfield, 1993; Singer, 1998). An intraclass correlation indicates the proportion of the total variance occurring between schools. As Table 3 indicates, 5% of the total variance in grade point average is accounted for by institution to institution differences.

Limiting the Model

Entering all of the level one and level two variables in the HLM model caused the HLM model to not reach convergence. Because of this, the large number of predictors included in the study, the number of variables included in the HLM analysis needed to be reduced to allow the model to converge. To reduce the number of variables, the results from the OLS regression equation were used. The variables predicting grade point average at the $p<.05$ level were retained for use in the HLM analysis. These variables are listed in Table 4.

INSERT TABLE 4 HERE

The HLM Model

The resulting variables, listed in Table 4, were entered into the HLM. To build the model, all of the level 1 and level 2 variables were grand centered.. Centering when using level 2 variable to predict level 1 coefficients is an effective strategy due to the nature of the interaction term when the level one and level two equations are combined. When the equations are combined, an interaction term, consisting of the level one variable multiplied by the level two variable is created. This interaction term is correlated with both the level one and level two variables. By centering the variables, the correlation is eliminated because the equation now reflects the randomly varying variance that should not be correlated (Singer, 1998).

The coefficients and significance levels for all of the variables are listed in Table 5. Of particular interest to this study is the significance of four-year mission on the intercept for grade point average and the slopes for high school rank, student effort, and classroom experiences.

INSERT TABLE 5 HERE

Interpretation of the Model

One way of measuring how much variation in between institutions' institutional commitment scores has been impacted by sector is to compute how much the variance between institutions (tau) has changed between the unconditional model and the final model (Bryk & Raudenbush, 1992; Singer, 1998). This is computed by using the formula tau (unconditional) – tau (final model) / tau (unconditional) or [(.02-.01)/.02 = .50] indicating that 50% of the variance between institutions' grade point average scores is explained by the final model.

Intercept

The model indicates that the intercept coefficient, 2.95 is significant at the $p<.01$ level. This information along with the coefficient for sector indicates that the value of student grade point average at the intercept for two-year institutions is .11 higher than the value for student grade point average for four-year institutions. The intercept value for two-year institutions is 3.06, and for four-year institutions it is 2.95.

Structural/Organizational Characteristics

Of the five structural/organization characteristics (mission, size, wealth, selectivity, and complexity) only four-year mission is a significant predictor in the final model.

Because sector is significant, the HLM equation can be re-written into a pair of fitted models, one for each sector, substituting the values for the two-year and four-year institutions (Singer, 1998). These equations are contained in Table 6. These equations can be used to illustrate the regression lines for two-year and four-year institutions. Substituting the values for each variable shown in Table 6 for the 25th, 50th, and 75th percentiles, the two separate regression lines for two-year and four-year institutions can be drawn. The regression lines in Figure 1 depict the higher value for student grade point average at the intercept for students at four-year institutions. With this trend pervading, and increasing as the values of the independent variables increase.

[INSERT TABLE 6 HERE]

[INSERT FIGURE 1 HERE]

Pre-College Characteristics

Four pre-college characteristics, high school rank, total SAT score, being male, and the number of hours worked are retained in the final model.

The average slope representing the relationship between high school rank and grade point average is .0003. This relationship is affected by institutional type. Although both significant, but trivial, the slope is steeper at four-year institutional than at two-year institutions. With a significant p value (<.01). it is concluded that a significant relationship exists between high school rank and grade point average. However, the extremely small impact of this relationship, indicates that the effect is minimal.

The average slope representing the relationship between total SAT score and grade point average is .00. With a significant p value (.00), but again, trivial impact, it is concluded that there is a statistically significant relationship with little impact of total SAT score and grade point average.

The average slope representing the relationship between being male and grade point average is -.07. With a significant p value (.00), it is concluded that there is a statistically significant negative relationship between being male and grade point average.

The average slope representing the relationship between number of hours worked per week and grade point average is .01. With a significant p value (.01) it is concluded that there is a statistically significant positive relationship between the number of hours worked and grade point average.

Classroom Experiences

The relationship between classroom experiences and grade point average vary according to institutional mission. Although classroom experiences are significant predictors of grade point average at both two-year and four-year institutions, this relationship is stronger at four-year institutions than at two-year institutions. The classroom experience slope at four-year institutions is .05 higher than the classroom experience at two-year institutions.

Effort

Institutional mission impacts the relationship between student effort and grade point average. Effort is a significant predictor of grade point average at both two year and four-year institutions, however, the effort slope is .06 higher at two-year institutions.

## Student Growth Analysis

**OLS Regression**

An OLS regression was used to predict growth. The independent variables were entered in the same blocks order as the OLS regression for grade point average. Listwise deletion of missing cases was used for missing data.

The results, reported in Table 7, indicate that the impact of financial aid, being male, the mission of the institution, clarity of educational and occupational objectives, involvement, peer support, perceived climate for tolerance of differences, satisfaction with academic facilities, classroom experiences, institutional commitment, and effort are all significant predictors of growth. The adjusted $R^2$ for this model was .423, indicating that this model accounted for 42% of the total variance in growth scores.

[INSERT TABLE 7 HERE]

**HLM Analysis**

Unconditional Model

As was the case with the grade point average, an unconditional model to examine the variance between institutions. The results are listed in Table 8.

INSERT TABLE 8 HERE

Table 8 indicates that the maximum likelihood point estimate for the grand-mean grade point average is 3.57 with a standard error of .02, indicating a 95% confidence interval of 3.57+or- 1.96(.02)= (3.53.3.69). The estimated value of the variance at the student level, or within schools, of institutional commitment scores, represented by sigma squared, is .72. The estimated value of the variance at the school level (i.e. between individual institutions) of institutional commitment scores, represented by tau, is .02. These estimates indicate that most of

the variation in the outcome is at the student level, although a substantial and statistically significant portion ($p<.01$) exists between individual schools.

Intraclass Correlation

A intraclass correlation was used to again test the variance between institutions. As Table 8 indicates, 8% of the total variance in growth is accounted for by institution to institution differences.

Limiting the Model

Again, the HLM model suffered from a lack of convergence. As with the case for grade point average, the number of predictors in the model needed to be reduced. The significant predictors from the OLS regression equation were used for the final HLM analysis. These variables are listed in Table 9.

INSERT TABLE 9 HERE

The HLM Model

The resulting variables, listed in Table 9, were entered into the HLM. The variables were again grand mean centered.

The coefficients and significance levels for all of the variables are listed in Table 10. Again, four-year mission was the only significant level two variable, having an impact on the intercept for growth.

INSERT TABLE 10 HERE

Interpretation of the Model

The change in variance accounted for in the model was again calculated using the formula tau (unconditional) – tau (final model) / tau (unconditional) or [(.02129-.00151)/.02129 = 93] indicating that 93% of the variance between institutions' growth scores is explained by the final model.

Intercept

The model indicates that the intercept coefficient, 3.58 is significant at the $p<.01$ level. This information along with the coefficient for sector indicates that the value of growth at the intercept for four-year institutions is .09 higher than the value for student grade point average for two-year institutions. The intercept value for two-year institutions is 3.58, and for four-year institutions it is 3.67.

Structural/Organizational Characteristics

Of the five structural/organization characteristics (mission, size, wealth, productivity and complexity) only mission was a significant predictor in the final model.

As was the case for grade point average, four-year mission is significant for the intercept of growth. Again, two equations, contained in Table 11, were written, one for the two-year sector, and one for the four-year sector. These equations illustrate the regression lines for two-year and four-year institutions by substituting the values for each variable shown in table 11 for the $25^{th}$, $50^{th}$, and $75^{th}$ percentiles. The regression lines in Figure 2 depict the higher value for growth at the intercept for students at two-year institutions.

[INSERT TABLE 11 HERE]

[INSERT FIGURE 2 HERE]

Interactions with Agents of Socialization and Institutional Environment

Clarity of objectives, involvement, peer support, and, classroom experiences were all significant positive predictors of student growth ($p<.01$). Satisfaction with academic facilities was also significant ($p<.02$). Perceived climate of tolerance was a negative significant predictor of growth ($p<.01$).

Institutional Commitment

Institutional commitment was a significant predictor of growth. With a significance of $p<.01$), institutional commitment has a positive relationship with growth.

Effort

Student effort was the final variable that significantly predicting growth. Having a $p<.01$, effort contributed significantly to the prediction of student growth.

## Discussion and Conclusions

This study examines student outcomes in relation to the structural/organizational characteristics of the 51 campuses that they attend. The study first finds that organizational measures of mission, size, wealth, complexity, and selectivity are statistically represented by the two-year versus four-year college dimension. The different missions of two-year versus four-year campuses indeed do exert significantly different influences on undergraduate GPA and self-reported growth. The study uses both OLS regression and HLM to examine these influences, and finds the HLM models to be more predictive.

### Grade Point Average

Similarities between OLS and HLM

The exact same set of student level variables predicts grade point average in both the OLS and the HLM models. In both cases, higher high school rank and larger total SAT scores significantly predicts higher grade point averages. Additionally, the results reveal that working more hours per week predicted a higher grade point average. Being male has an inverse relationship with grade point averages, indicating that in this sample, being males is related to lower grade point averages. Quantitatively, more, and better classroom experiences results in higher grade point averages, as well as self-report of greater effort.

The relationships between high school rank and total SAT scores and grade point averages are in the expected direction. Following the Cabrera et. al. model (1993) and the findings by Pascarella and Terenzini (1991), pre-college academic achievement, such as high school rank and total SAT scores are significant predictors of grade point average. Similarly, most literature reviewed by Pascarella and Terenzini (1991) finds that males tend to earn lower grade point averages than females.

The positive impact of classroom experiences on grade point average reinforces Volkwein & Cabrera's (2000) assertion that the classroom plays an essential part in the learning experience of students.

One surprise is the positive relationship between number of hours worked and grade point average. This may be due to characteristics of the students. Students who earn higher

grades may also be students who work harder and longer. This work ethic may apply to both academic work and occupational work.

Differences Between OLS and HLM

Despite sharing the same set of predictors, the HLM analysis reveals a greater understanding of the nature between three of the variables and growth. Attending a two-year or four-year institution significantly impacted the relationship between high school rank and grade point average, classroom experiences and grade point average, and effort and grade point average.

Specifically, the HLM results indicate that attending a two-year institution results in a flatter slope for high school rank and classroom experience. This means that high school rank and the classroom experiences are less predictive of grade point average at two-year institutions than at four-year institutions.

The HLM results also reveal that students at two-year institutions have a stronger relationship, though still significant, between effort and grade point average. Hence the perception of effort is more important when predicting grade point average at two-year institutions.

Model Differences

In examining the amount of variance explained by each model, the adjusted $R^2$ value for the OLS model is compared to the change in tau reported by HLM. This comparison indicates that the HLM model accounts for 50% of the variance in grade point average, as compared to 27% accounted for by the OLS model. Hence, for this study, it appears as though HLM is a better analytical tool in determining the predictors of grade point average.

**Growth**

Similarities between OLS and HLM

The OLS and the HLM analyses share a number of similarities. Clarity of educational and occupational objectives, involvement, peer support, perceived climate of tolerance, satisfaction with academic facilities, classroom experiences, institutional commitment, and effort all are significant predictors of growth in both models.

The positive relationship between the independent variables of clarity of educational and occupational objectives, involvement, peer support, classroom experiences, institutional commitment and effort and the dependent variable of growth generates a profile of a student who

is involved, both academically and social in her or his institution. From the work of Spady (1970, 1971), Tinto (1993), and more recently Cabrera et. al (1993) the connection between these aspects of student involvement, both in and out of the classroom, have been positively related to not only student growth, but student learning, and persistence.

One surprise in the results is the negative relationship between growth and perceiving a climate of tolerance. Students who perceived a less tolerant environment are more likely to experience more growth. According to the Cross model (1991), students exploring their identity become immersed in the issues of identity formation, and consequently become more sensitive to environmental circumstances. Subsequently, these students may perceive their campus environment to be less tolerant of differences. Thus students experiencing tremendous amounts of personal growth, and may also report a more problem filled environment.

Differences between OLS and HLM

The OLS model has three additional predictors of growth that are not in the HLM model. These predictors are the impact of financial aid, being male, and satisfaction with recreational facilities. Of particular interest to this study is the absence of any structural organizational characteristics as impacting the relationship between the independent student level variables and growth. Mission is significant only for the intercept, indicating that the intercept value for growth at two –year institutions is slightly higher than the intercept for students at four-year institutions.

Model Differences

Examining the amount of variance explained by each model, the adjusted $R^2$ for the OLS model is again compared to the change in tau reported in HLM. The adjusted $R^2$ indicates that the OLS model accounts for 42% of the variance in growth scores. In comparison, the HLM model accounts for 93% of the variance in growth scores, the $p>.05$ for the final estimation of variance for the intercept in Table 10 also demonstrates this outcome.

While this study draws upon a rich outcomes dataset of 7,658 second-year students at 51 public college campuses, the results may not be completely transportable to non-public institutions and to other states. Additionally, the results are limited to the population of second year students included in the study for analysis. These second year students represent only those who have successfully persisted at their respective institutions. Results from this study may not

be generalizable to students who do not persist into their second year. Such persistence may also vary by institution type (i.e. two vs. four-year institutions).

The study examines both student GPA and self-reported growth as important outcomes of the collegiate experience. Although grade point average and self-reported growth have become accepted as measures of student performance and growth, these may not be the best measures of student learning (Pascarella, 1985). Subsequent research should attempt other measures of cognitive outcomes.

This study also was limited to a two-level HLM analysis, and thus may have missed important within-campus influences due to the student's major field of study or membership in a particular subpopulation. Future analyses with this or other similar datasets should attempt three-level HLM to explore these effects.

However, the findings presented here indicate that the different missions of two-year versus four-year campuses indeed do exert significantly different influences on undergraduate GPA and self-reported growth. While the student level predictor variables in the OLS and HLM models are substantially similar, the HLM results are more robust because they take into account the interaction effects between campus mission and students.

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**Table 1**
**Descriptive Statistics and Scale Alphas**

| | Mean | Std. Deviation | Scale Alpha | Number of Scale Items |
|---|---|---|---|---|
| Grade Point Average | 2.963 | 0.601 | n/a | n/a |
| Growth (Scale) | 3.569 | 0.860 | 0.89 | 6 |
| Age | 3.775 | 1.673 | n/a | n/a |
| High School Rank | 605.115 | 234.104 | n/a | n/a |
| Total SAT Score | 911.965 | 184.765 | n/a | n/a |
| Number of Hours Worked Per Week | 2.769 | 1.611 | n/a | n/a |
| Number of Dependent Children | 1.349 | 0.847 | n/a | n/a |
| Impact of Financial Aid | 2.539 | 1.272 | 0.88 | 2 |
| Being Male | 0.423 | 0.494 | n/a | n/a |
| Self-report as a Member of an Underrepresented Group | 0.109 | 0.311 | n/a | n/a |
| Marital Status | 0.118 | 0.323 | n/a | n/a |
| Selectivity | 0.873 | 0.107 | n/a | n/a |
| Size | 6436.297 | 5343.574 | n/a | n/a |
| Wealth | 13459.154 | 18013.857 | n/a | n/a |
| Complexity | 5.428 | 3.753 | n/a | n/a |
| Four-Year Mission | 0.334 | 0.472 | n/a | n/a |
| Family Strong Support | 3.865 | 1.248 | n/a | n/a |
| Friends Strong Support | 3.494 | 1.213 | n/a | n/a |
| Clarity of Educational and Occupational Objectives (Scale) | 4.062 | 0.937 | 0.84 | 3 |
| Interaction with Faculty Outside the Classroom (Scale) | 3.606 | 0.794 | 0.77 | 4 |
| Classroom Experiences (Scale) | 3.720 | 0.815 | 0.77 | 8 |
| Involvement in the Community and Outside the Classroom (Scale) | 3.288 | 0.704 | 0.76 | 2 |
| Peer Support (Scale) | 3.758 | 1.043 | 0.86 | 2 |
| Perceived Climate of Low Prejudice (Scale) | 3.613 | 0.957 | 0.90 | 3 |
| Perceived Climate for Tolerance of Differences (Scale) | 3.357 | 0.630 | 0.74 | 5 |
| Perceived Climate for Fostering Diversity (Scale) | 3.404 | 0.676 | 0.77 | 4 |
| Satisfaction with Academic Facilities (Scale) | 3.476 | 0.565 | 0.83 | 11 |
| Satisfaction with Registration and Billing (Scale) | 3.372 | 0.939 | 0.75 | 2 |
| Institutional Commitment (Scale) | 3.689 | 0.792 | 0.77 | 4 |
| Student Effort (Scale) | 3.566 | 0.994 | 0.80 | 2 |

**Table 2**

## OLS and HLM Analyses: Dependent Variable Grade Point Average

| | OLS BETA | HLM BETA | |
|---|---|---|---|
| (Constant) | | 2.952 | (Constant) |
| | | -0.106 | MISSION |
| Age | | | Age |
| High School Rank | 0.255 | 0.000 | High School Rank |
| | | 0.000 | Four-year mission |
| Total SAT Scores | 0.251 | 0.000 | Total SAT Scores |
| Self-report as a member of an underrepresented group | | | Self-report as a member of an underrepresented group |
| Married | | | Married |
| Number of hours worked per week | 0.052 | 0.013 | Number of hours worked per week |
| Number of dependent children | | | Number of dependent children |
| Impact of Financial Aid (Scale) | | | Impact of Financial Aid (Scale) |
| Being Male | -0.052 | -.067 | Being Male |
| Four-year mission | -0.124 | | Four-year mission |
| Selectivity | | | Selectivity |
| Size | | | Size |
| Wealth | | | Wealth |
| Complexity | | | Complexity |
| Family strong support for academic goals | | | Family strong support for academic goals |
| Friends strong support for academic goals | | | Friends strong support for academic goals |
| Clarity of educational and occupational objectives (Scale) | | | Clarity of educational and occupational objectives (Scale) |
| Quality and extent of interaction with faculty outside the classroom (Scale) | | | Quality and extent of interaction with faculty outside the classroom (Scale) |
| Involvement in the community and outside the classroom (Scale) | | | Involvement in the community and outside the classroom (Scale) |
| Climate of perceived low prejudice (Scale) | | | Climate of perceived low prejudice (Scale) |
| Climate of perceived tolerance (Scale) | | | Climate of perceived tolerance (Scale) |
| Perceived climate fostering diversity (Scale) | | | Perceived climate fostering diversity (Scale) |
| Satisfaction with registration and billing procedures (Scale) | | | Satisfaction with registration and billing procedures (Scale) |
| Classroom experiences (Scale) | 0.136 | 0.115 | Classroom experiences (Scale) |
| | | 0.049 | Four-year mission |
| Institutional Commitment (Scale) | | | Institutional Commitment (Scale) |
| Student effort (Scale) | 0.193 | 0.137 | Student effort (Scale) |
| | | -.063 | Four-year mission |

P<.05

**Table 3**
**HLM Unconditional Model: Dependent Variable Grade Point Average**

Fixed Effect

| | Coefficient | Standard Error | T-ratio | d.f. | P-value |
|---|---|---|---|---|---|
| Intercept for GPA, B0 | | | | | |
| INTRCPT2, G00 | 2.919995 | 0.021198 | 137.749 | 47 | 0.000 |

Random Effect

| | Standard Deviation | Variance Component | df | Chi-square | P-value |
|---|---|---|---|---|---|
| Intercept for GPA, U0 | 0.13542 | 0.01834 | 47 | 315.92982 | 0.000 |
| level-1, variance R | 0.64881 | 0.42095 | | | |

Intraclass Correlation

Tau =.02
Sigma Squared=.42
Tau/(tau+sigma) squared = .06/(.06+.56) = .05

**Table 4**

**Variables used in hlm analysis**

| | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|
| | B | Std. Error | Beta | | |
| (Constant) | 1.042 | 0.232 | | 4.482 | 0.000 |
| High School Rank | 0.001 | 0.000 | 0.255 | 9.141 | 0.000 |
| Total SAT scores | 0.001 | 0.000 | 0.251 | 8.801 | 0.000 |
| Number of Hours Worked | 0.020 | 0.010 | 0.052 | 2.069 | 0.039 |
| Four-Year Mission | -0.144 | 0.044 | -0.124 | -3.291 | 0.001 |
| Classroom Experiences | 0.107 | 0.023 | 0.136 | 4.612 | 0.000 |
| Student Effort | 0.109 | 0.014 | 0.193 | 7.769 | 0.000 |

Level one
- High School Rank
- Total SAT Score
- Number of Hours Worked per week
- Being Male
- Classroom Experiences
- Student Effort

Level Two
- Mission

**Table 5**
**HLM Model: Dependent Variable Grade Point Average**

Fixed Effect

| | Coefficient | Standard Error | T-ratio | Approx. d.f. | P-value |
|---|---|---|---|---|---|
| Intercept of GPA, B0 | | | | | |
| Intercept , G00 | 2.952332 | 0.017550 | 168.226 | 46 | 0.000 |
| Four-Year Mission, G01 | -0.106350 | 0.034344 | -3.097 | 46 | 0.004 |
| High School Rank slope, B1 | | | | | |
| Intercept, G10 | 0.000272 | 0.000044 | 6.163 | 46 | 0.000 |
| Four-Year Mission, G11 | 0.000299 | 0.000071 | 4.182 | 46 | 0.000 |
| Total SAT score slope, B2 | | | | | |
| Intercept, G20 | 0.000304 | 0.000057 | 5.302 | 47 | 0.000 |
| Student Effort slope, B3 | | | | | |
| Intercept, G30 | 0.136515 | 0.008185 | 16.680 | 46 | 0.000 |
| Four-Year Mission, G31 | -0.062736 | 0.014810 | -4.236 | 46 | 0.000 |
| Number of Hours Worked slope, B4 | | | | | |
| Intercept, G40 | 0.013266 | 0.005106 | 2.598 | 47 | 0.013 |
| Classroom Experience slope, B5 | | | | | |
| Intercept, G50 | 0.114627 | 0.009644 | 11.886 | 46 | 0.000 |
| Four-Year Mission, G51 | 0.049018 | 0.019075 | 2.570 | 46 | 0.014 |
| Being Male slope, B6 | | | | | |
| Intercept, G60 | -0.067237 | 0.014716 | -4.569 | 47 | 0.000 |

Random Effect

| | Standard Deviation | Variance Component | df | Chi-square | P-value |
|---|---|---|---|---|---|
| Intercept of GPA , U0 | 0.09395 | 0.00883 | 41 | 179.61883 | 0.000 |
| High School Rank slope, U1 | 0.00018 | 0.00000 | 41 | 86.67835 | 0.000 |
| Total SAT score slope, U2 | 0.00024 | 0.00000 | 42 | 94.96947 | 0.000 |
| Student Effort slope, U3 | 0.03321 | 0.00110 | 41 | 57.32420 | 0.046 |
| Number of Hours Worked slope, U4 | 0.02224 | 0.00049 | 42 | 68.23414 | 0.007 |
| Classroom Experiences slope, U5 | 0.02658 | 0.00071 | 41 | 39.13462 | >.500 |
| Being Male slope, U6 | 0.04545 | 0.00207 | 42 | 70.81646 | 0.004 |
| level-1 variance, R | 0.54314 | 0.29500 | | | |

**Table 6**
**HLM Sector Equations**

Two-Year Equation

Grade Point Average=3.06 + (.00*high school rank) + (.00*total SAT score) – (.06*being male) + (.13*number of hours worked) + (.11*classroom experiences) + (.13*effort)

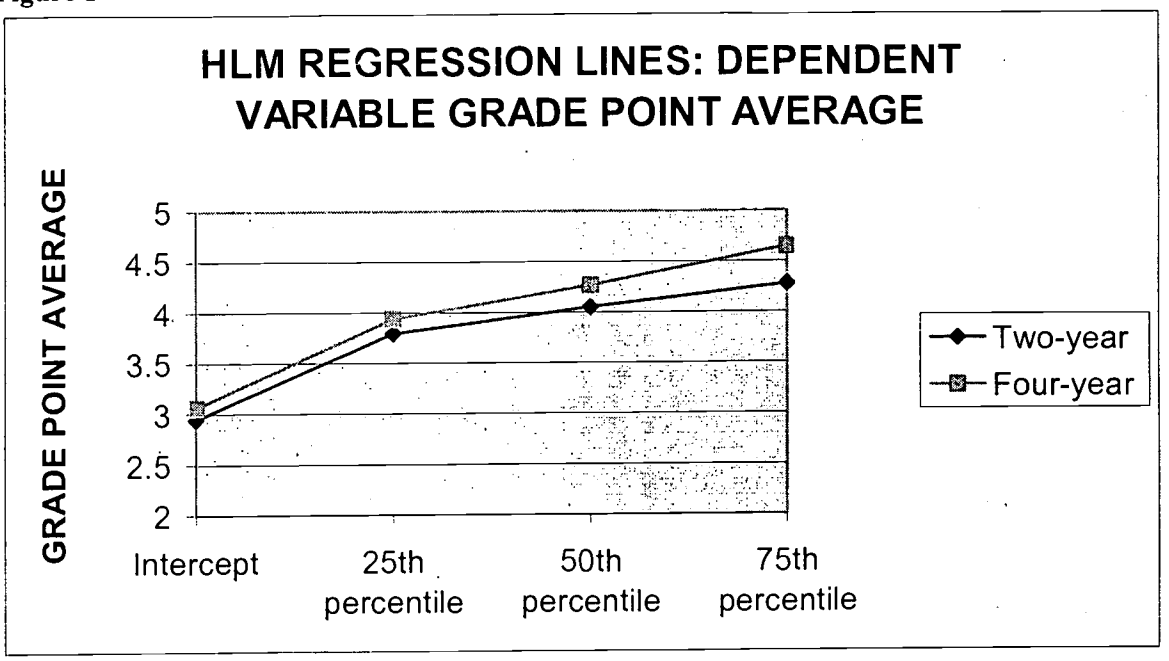
Four-Year Equation

Grade Point Average=2.95 + (.00*high school rank) + (.00*total SAT score) – (.06*being male) + (.13*number of hours worked) + (.16*classroom experiences) + (.07*effort)

Fitted Grade Point Average Values for the 25th, 50th, and 75th percentile by Two-year and Four-year Institutions

| | TWO-YEAR | FOUR-YEAR |
|---|---|---|
| INTERCEPT | 3.06 | 2.95 |
| 25TH PERCENTILE VALUES | 3.94 | 3.79 |
| 50TH PERCENTILE VALUES | 4.27 | 4.05 |
| 75TH PERCENTILE VALUES | 4.65 | 4.28 |

**Figure 1**




HLM

Regression Lines for Two-year and Four-year institutions: Dependent variable Grade Point Average

**Table 7**

## OLS and HLM Analyses: Dependent Variable Growth

| | OLS BETA | HLM BETA | |
|---|---|---|---|
| (Constant) | | 3.579 | (Constant) |
| | | 0.089 | Four-year mission |
| Age | | | Age |
| High School Rank | | | High School Rank |
| Total SAT Scores | | | Total SAT Scores |
| Self-report as a member of an underrepresented group | | | Self-report as a member of an underrepresented group |
| Married | | | Married |
| Number of hours worked per week | | | Number of hours worked per week |
| Number of dependent children | | | Number of dependent children |
| Impact of Financial Aid (Scale) | 0.038 | | Impact of Financial Aid (Scale) |
| Being Male | 0.038 | | Being Male |
| Size | | | Size |
| Wealth | | | Wealth |
| Complexity | | | Complexity |
| Four-year mission | 0.068 | | Four-year mission |
| Family strong support for academic goals | | | Family strong support for academic goals |
| Friends strong support for academic goals | | | Friends strong support for academic goals |
| Clarity of educational and occupational objectives (Scale) | 0.041 | 0.060 | Clarity of educational and occupational objectives (Scale) |
| Quality and extent of interaction with faculty outside the classroom (Scale) | | | Quality and extent of interaction with faculty outside the classroom (Scale) |
| Involvement in the community and outside the classroom (Scale) | 0.058 | 0.044 | Involvement in the community and outside the classroom (Scale) |
| Peer Support in College (Scale) | 0.082 | 0.086 | Peer Support in College (Scale) |
| Climate of perceived low prejudice (Scale) | | | Climate of perceived low prejudice (Scale) |
| Climate of perceived tolerance (Scale) | -0.072 | 048809 | Climate of perceived tolerance (Scale) |
| Perceived climate fostering diversity (Scale) | | | Perceived climate fostering diversity (Scale) |
| Satisfaction with registration and billing procedures (Scale) | 0.062 | | Satisfaction with registration and billing procedures (Scale) |
| Satisfaction with campus academic facilties (Scale) | 0.091 | 0 047 | Satisfaction with campus academic facilties (Scale) |
| Classroom experiences (Scale) | 0.266 | 0 274 | Classroom experiences (Scale) |
| Institutional Commitment (Scale) | 0.325 | 0 348 | Institutional Commitment (Scale) |
| Student effort (Scale) | 0.113 | 0.094 | Student effort (Scale) |

P< 05

**Table 8**

**HLM Unconditional Model: Dependent Variable Growth**

Fixed Effect

| | Coefficient | Standard Error | T-ratio | d.f. | P-value |
|---|---|---|---|---|---|
| Intercept for Growth, B0 INTRCPT2, G00 | 3.571145 | 0.023653 | 150.983 | 47 | 0.000 |

Random Effect

| | Standard Deviation | Variance Component | df | Chi-square | P-value |
|---|---|---|---|---|---|
| Intercept for Growth U0 | 0.14592 | 0.02129 | 47 | 242.45879 | 0.000 |
| level-1, varience R | 0.85248 | 0.72672 | | | |

Intraclass Correlation
Tau =.02
Sigma Squared=.72
Tau/(tau+sigma) squared = .06/(.06+.72) = .08

**Table 9**

GROWTH

| | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|
| | B | Std. Error | Beta | | |
| Impact of Financial Aid | 0.025 | 0.013 | 0.038 | 1.900 | 0.06 |
| Being Male | -0.063 | 0.034 | -0.038 | -1.881 | 0.06 |
| Clarity of Educational and Occupational Goals | 0.036 | 0.018 | 0.041 | 2.004 | 0.05 |
| Involvement | 0.064 | 0.027 | 0.058 | 2.337 | 0.02 |
| Peer Support | 0.066 | 0.019 | 0.082 | 3.474 | 0.00 |
| Perceived Climate of Tolerance | -0.092 | 0.035 | -0.072 | -2.623 | 0.01 |
| Satisfaction with Academic Facilities | 0.139 | 0.043 | 0.091 | 3.229 | 0.00 |
| Classroom Experiences | 0.297 | 0.029 | 0.266 | 10.127 | 0.00 |
| Institutional Commitment | 0.331 | 0.029 | 0.325 | 11.550 | 0.00 |
| Student Effort | 0.091 | 0.018 | 0.113 | 5.093 | 0.00 |
| Four-Year Mission | 0.112 | 0.056 | 0.068 | 2.011 | 0.04 |

Level one

- Impact of Financial Aid
- Being Male
- Clarity of Educational and Occupational Objectives
- Involvement
- Peer Support
- Perceived Climate for Tolerance of Differences
- Satisfaction with Academic Facilities
- Classroom Experiences
- Institutional Commitment
- Student Effort

Level Two

- Mission

**Table 10**

# HLM MODEL: DEPENDENT VARIABLE GROWTH

Fixed Effect

| | Coefficient | Standard Error | T-ratio | Approx. d.f. | P-value |
|---|---|---|---|---|---|
| Intercept for Growth, B0 | | | | | |
| Intercept, G00 | 3.579178 | 0.010177 | 351.678 | 46 | 0.000 |
| Four-Year Mission, G01 | 0.088797 | 0.021356 | 4.158 | 46 | 0.000 |
| Clarity of Educational Objectives slope, B1 | | | | | |
| Intercept, G10 | 0.059952 | 0.009621 | 6.231 | 47 | 0.000 |
| Student Effort slope, B2 | | | | | |
| Intercept, G20 | 0.094146 | 0.008058 | 11.683 | 47 | 0.000 |
| Involvement slope, B3 | | | | | |
| Intercept, G30 | 0.044120 | 0.012059 | 3.659 | 47 | 0.001 |
| Peer Support slope, B4 | | | | | |
| Intercept, G40 | 0.086481 | 0.009091 | 9.513 | 47 | 0.000 |
| Perceived Climate of Tolerance slope, B5 | | | | | |
| Intercept, G50 | -0.048809 | 0.015987 | -3.053 | 47 | 0.004 |
| Satisfaction with Academic Facilities slope, B6 | | | | | |
| Intercept, G60 | 0.047475 | 0.019010 | 2.497 | 47 | 0.016 |
| Institutional Commitment slope, B7 | | | | | |
| Intercept, G70 | 0.348281 | 0.020457 | 17.025 | 47 | 0.000 |
| Classroom slope, B8 | | | | | |
| Intercept, G80 | 0.274367 | 0.017393 | 15.774 | 47 | 0.000 |

Random Effect

| | Standard Deviation | Variance Component | df | Chi-square | P-value |
|---|---|---|---|---|---|
| Intercept for Growth, U0 | 0.03884 | 0.00151 | 46 | 60.40087 | 0.075 |
| Clarity of Educational Objectives, U1 | 0.03131 | 0.00098 | 47 | 63.47250 | 0.055 |
| Student Effort, U2 | 0.02503 | 0.00063 | 47 | 45.48664 | >.500 |
| Involvement, U3 | 0.03238 | 0.00105 | 47 | 40.32519 | >.500 |
| Peer Support , U4 | 0.02666 | 0.00071 | 47 | 58.61229 | 0.119 |
| Perceived Tolerance U5 | 0.05146 | 0.00265 | 47 | 53.62294 | 0.235 |
| Satisfaction with Academic, U6 | 0.07200 | 0.00518 | 47 | 58.91481 | 0.114 |
| Institutional Commitment, U7 | 0.10039 | 0.01008 | 47 | 82.53579 | 0.001 |
| Classroom , U8 | 0.07967 | 0.00635 | 47 | 86.39360 | 0.001 |
| level-1 variance, R | 0.64744 | 0.41917 | | | |

**Table 11**

## HLM SECTOR EQUATIONS FOR GROWTH MODEL

Two-Year Equation

Growth=3.58 + (.06*clarity) + (.04*involvement) + (.00*peer support) – (.05*perceived climate for tolerance) + (.05*satisfaction with academic facilities) + (.27*classroom experiences) + (.35*institutional commitment) + (.09*effort)

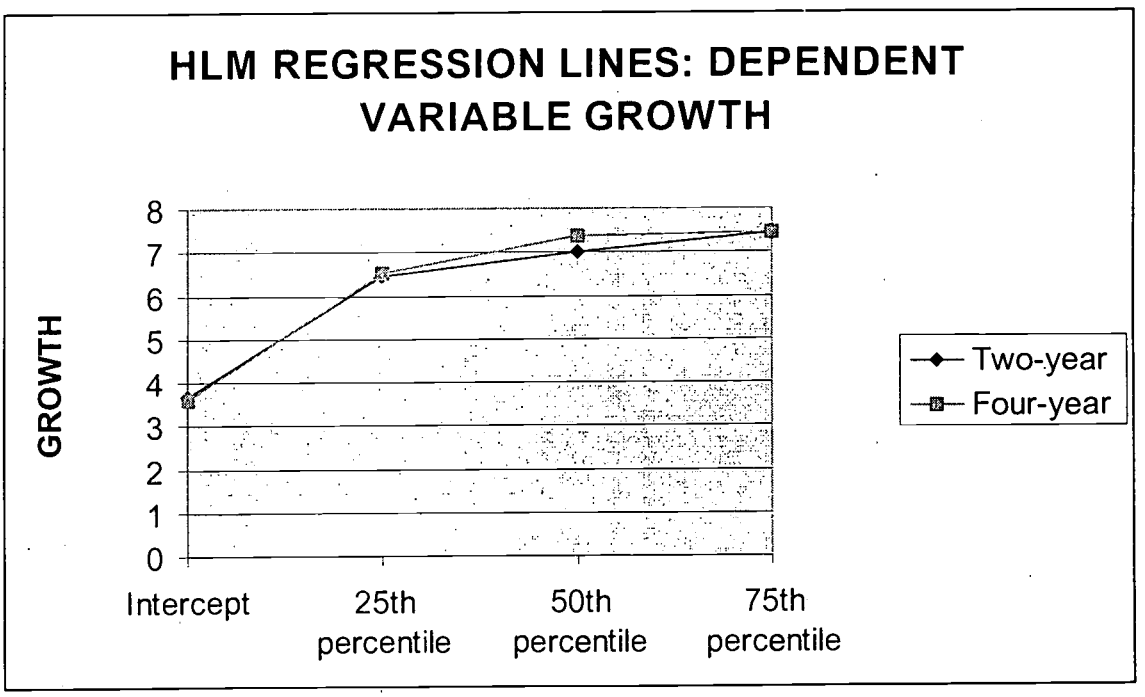
Four-Year Equation

Growth=3.67 + (.06*clarity) + (.04*involvement) + (.00*peer support) - (.05*perceived climate for tolerance) + (.05*satisfaction with academic facilities) + (.27*classroom experiences) + (.35*institutional commitment) + (.09*effort)

Fitted Growth Values for the 25th, 50th, and 75th percentile by Two-year and Four-year Institutions

| | TWO-YEAR | FOUR-YEAR |
|---|---|---|
| INTERCEPT | 3.67 | 3.58 |
| 25TH PERCENTILE VALUES | 6.46 | 6.53 |
| 50TH PERCENTILE VALUES | 7.00 | 7.36 |
| 75TH PERCENTILE VALUES | 7.46 | 7.45 |

Figure 2




HLM

Regression Lines for Two-year and Four-year Institutions: Dependent variable Growth

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